

positioning a plurality of spaced point light sources connected to a flexible electrical connecting member within said volume between said side walls; and essentially filling said volume with a potting material transmitting light.

REMARKS

Claims 2-4, 6-18, and 24-51 are pending in the present case.

Applicants gratefully acknowledge the indication of allowance of claims 5-13 if rewritten into independent form and the rejection under 35 U.S.C. § 112 is overcome, and the indication of allowance of claims 22-39 if rewritten into independent form and/or if the rejection under 35 U.S.C. § 112 is overcome. To this end, Applicants have cancelled claims 5 and 23 and rewritten them as new independent claims 41 and 42, respectively. Claim 41 is believed to have all of the limitations of cancelled claims 1 and 5 and addresses the 35 U.S.C. § 112 issues raised by the Examiner. Similarly, claim 42 is believed to have all of the limitations of cancelled claim 23 and addresses the 35 U.S.C. § 112 issues raised by the Examiner. Finally, Applicants have also amended independent claim 34 to address the 35 U.S.C. § 112 issues raised by the Examiner.

Before discussing the specific amendments to the claims, Applicants believe it to be beneficial to review the essential features and advantages of the present invention to place the discussion that follows in proper context.

One of the essential features of the present invention is the uniformity and intensity of the light emitted by the illumination device. While it is important that the disadvantages of neon lighting be avoided (for example, weight and fragility), an illumination device would have little commercial or practical value if the proper light uniformity and intensity could not be obtained.

Applicants' invention achieves this objective primarily through the use of a "leaky" waveguide rod. As specifically pointed out and defined on page 9, lines 5-9 of the pending application, a "leaky" waveguide is structural member that functions **both as an optical waveguide and light scattering member**. As a waveguide, it tends to preferentially direct light entering the waveguide, including the light entering a lateral surface thereof, along the axial direction of the waveguide, while as a light scattering member, it urges the light out of an opposite lateral surface of the waveguide. As a result, what is visually perceived is an elongated light pattern being emitted along the light emitting lateral surface of the waveguide. Appropriate materials used in the construction of the preferred illumination device to achieve the desired "leaky" waveguide properties are described on page 11, lines 7-19 of the present application.

Furthermore, when discrete light sources are used, it is very important that no "hot spots" appear. Thus, it is also a valuable feature of the present invention that the discrete point light sources (preferably light-emitting diodes) are positioned a sufficient distance from the light emitting lateral surface of the waveguide such that the resultant light pattern extends substantially about the circumferential width of the curved light emitting surface of the waveguide. This feature of the present invention is discussed in the present application on page 15, line 4 – page 16, line 10.

Finally, when using a plurality of point light sources, it is important that the oval light pattern emanating from each of the light sources overlap as depicted in Figures 7E and 7F of the present application and discussed on page 16, line 12 – page 17, line 13. Specifically, this is accomplished by appropriately spacing of the point light sources, taking into account the preferential scattering of the light along the length of the waveguide. In other words, proper

spacing of the point light sources and their distance from the light emitting surface of the waveguide, coupled with the preferential scattering characteristics of the “leaky” waveguide, provides for uniformity of the light intensity pattern emitted over substantially the entire light emitting surface of the waveguide.

35 U.S.C. § 112 Issue

The Examiner initially rejected claims 1-18 and 23-39 based on perceived indefiniteness or ambiguity in the phrase “preferentially scatters light” or variations thereof, specifically stating that it was not clear Applicants intended to limit the claims to such a feature. However, as discussed above, a structural member having waveguide properties is an essential part of the illumination device of the present invention. Furthermore, this structural member has been modified to “leak” light due to its light scattering properties. Stated differently, this structural member has **both optical waveguide and light scattering properties**. As a result, light is preferentially directed along the length of the waveguide, while the light scattering characteristics of the waveguide cause light to **leak** out its lateral surfaces. What is visually perceived is an elongated light pattern being emitted along the light emitting lateral surface of the waveguide. Such a structural member, a **leaky waveguide**, thus is carefully discussed and defined in the present application.

Referring now to the added claims, claim 41 (rewritten claim 5) specifically calls for such a structural member, specifically reciting:

said member being comprised of a material that has both optical waveguide and light scattering properties that preferentially scatters light entering said light receiving surface into an elongated light intensity pattern on said light emitting surface with a major axis extending along said predetermined length...

Applicants believe this to be a structural limitation and, in view of the foregoing discussion detailing support for this structural limitation in the description of the invention contained in the present application, provides adequate basis for allowing claim 41 and its dependent claims.

Similarly, claim 42 (rewritten claim 23) calls for the following structural limitations:

said member being comprised of a material that has both optical waveguide and light scattering properties that preferentially scatters light entering said light receiving surface into an elongated light intensity pattern on said light emitting surface with a major axis extending along said predetermined length...

and

said spaced point light sources positioned a distance from said curved front surface sufficient to allow a light intensity pattern from each of said point light sources to overlap neighboring light intensity patterns so that the light intensity pattern collectively emitted from said front surface appears uniform.

As is discussed in the present application on page 15, line 4 – page 16, line 2, it is important that the point light sources be spaced an appropriate distance from the front curved surface (i.e., the light emitting lateral surface) so that the light intensity patterns will overlap and provide a uniform light intensity along the curved surface. Placing the point light sources too far apart will result in hot spots and diminish the light intensity below acceptable levels. Placing them closer than necessary, of course, raises manufacturing expenses. Additionally, placing the point light sources too close to the curved surface of the waveguide results in hot spots. Since the recitations described above provide clear limitations on the scope of the claimed invention, claim 42 and its dependent claims are now also believed to be allowable.

Claim 34 and its associated dependent claims recite a method of making an illumination device and were determined to be allowable if the rejection under 35 U.S.C. § 112 were overcome. As discussed above, the “rod” is a “leaky” waveguide in that it has both optical

waveguide and light scattering properties such that light leaks from the rod to form an essentially elliptically shaped light intensity pattern along the length of the rod. As recited in claim 34:

forming a rod with a predetermined length and a pair of lateral surfaces from material having optical waveguide and light scattering properties so that light entering a first of said lateral surfaces is caused to form an elliptically shaped light intensity pattern that has a major axis in a direction substantially parallel to said predetermined length...

Such a claim limitation is clearly supported by the description of the invention contained in the present application. Thus, the statements made in support of the waveguide and light scattering properties of the rod, along with the amendment to claim 34, are believed to be adequate to overcome the initial 35 U.S.C. § 112 rejection, rendering claims 34-39 allowable.

35 U.S.C. § 102 Rejections

In the initial Office Action, the Examiner rejected claims 1-4, 14, and 16-21 of the pending patent application as being anticipated by U.S. Patent No. 6,361,186 issued to Slayden and U.S. Patent No. 6,158,882 issued to Bischoff, pursuant to 35 U.S.C. § 102(e). However, the '186 Patent describes the use of a hollow, thin-walled, translucent diffuser that provides no preferential scattering of light, a critical feature of the illumination device described and claimed in the present application. With respect to the '882 Patent, Bischoff describes his illumination device as comprising a light tube 12 with an interior space 16, the light tube 12 being an elongated, clear envelope 14 that functions to diffuse the light emitted by the diodes. Again, this reference contains no teaching or suggestion of the use of a rod with optical waveguide and light scattering characteristics, a "leaky" waveguide.

As the above discussion points out, to achieve the desired light intensity and uniformity, the rod must preferentially direct light along its length while also urging the light out of a lateral surface. This requires an essentially solid rod with optical waveguide and light scattering characteristics. Neither cited prior art reference teaches or suggests the use of an essentially solid rod, nor does either reference teach or suggest the use of a rod with optical waveguide and light scattering characteristics.

Therefore, for the reasons stated above, Applicants respectfully submit that none of the claims of the present application, as amended, are anticipated or obvious in view of U.S. Patent No. 6,361,186 or U.S. Patent No. 6,158,882.

Added Claims 43-51

Claim 43 and its associated dependent claims each recite an illumination device with the following structural element:

an essentially solid, leaky waveguide rod having a predetermined length with a lateral light receiving surface and a lateral light emitting surface...

As discussed with respect to the arguments concerning the prior art and cited patents to Slayden and Bischoff above, neither teach or suggest the use of such an “essentially solid leaky waveguide rod” in an illumination device. Therefore, Applicants respectfully submit that the illumination device, as recited in claim 43 and the dependent claims associated therewith, is novel and non-obvious in view of the cited prior art, and is thus allowable.

Furthermore, dependent claim 44 includes the following additional limitation:

transparent material filling at least a portion of said volume and abutting said light receiving surface and said light sources, said transparent material having an index of refraction that reduces Fresnel losses between said light sources and said waveguide.

Furthermore, none of the cited prior art references teach or suggest the use of any material between the light sources and their respective diffusing members that minimizes Fresnel light losses at the interfaces of the components. Quite to the contrary, Applicants discuss such a refinement in detail at page 14, lines 6-9 in the present application, specifically stating that it “is preferable that the potting compound harden into an impact resistant material having an index of refraction essentially matching that of the housing 24a of the LEDs 24 to minimize Fresnel losses at the interface there between.” Therefore, Applicants respectfully submit that the illumination device, as recited in claim 44 and the dependent claims associated therewith, is novel and non-obvious in view of the cited prior art, and is thus allowable irrespective of the allowability of claim 43.

Dependent claim 48 adds the structure of the LED spacing from the light emitting surface of the rod to permit overlapping of the light patterns, dependent claim 49 sets forth the specific material for the rod, and claims 50 and 51 add the features of walls having internally reflecting surfaces and externally light absorbing surfaces, respectively. Applicants note that the cited '186 and '882 patents are silent on this feature also. Therefore, these claims are believed allowable irrespective of the ultimate disposition of the independent claim 43.

In light of the foregoing amendments and remarks, Applicant respectfully requests allowance of all claims now pending in this Application.

Respectfully submitted,

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